Cumulative Effects of Agriculture on Water Quality in the Transboundary Sumas River Watershed

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This project used land use indicators such as livestock density, nitrogen budgets, and crop cover along with water and sediment analysis to investigate cumulative effects of agricultural intensification within a transboundary watershed. The salmon-bearing Sumas River watershed is characterized by high-density dairy farms in the U.S. and intensive hog and poultry operations in Canada. Results indicate that nitrate levels have significantly increased since 1993 in areas where livestock density is greatest. Trace metals such as copper and zinc, which are associated with livestock manure, were measured in the dissolved (water), total (sediment), and bioavailable fractions. A method known as the Diffusive Gradient Thin Film Technique (DGT) was used to determine differences in trace metal bioavailability between sites. Bioavailable zinc levels were consistently highest in Marshall Creek, which is fed by the Abbotsford Aquifer, and lowest in the Vedder Mountain control site. Since 1993, copper, potassium, phosphorus, and zinc have increased significantly in the sediments of tributaries associated with high-density agriculture. Zinc levels currently exceed interim sediment quality guidelines in several tributaries. Livestock density, percent pasture cover, and nitrogen surplus were significantly correlated to higher levels of nutrients and trace metals in water and sediment. The results indicate that improvements in manure storage infrastructure, manure exports, and/or livestock density limits may be required to remediate water and sediment quality.